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Examining the Impact of ASVAB Renorming Upon Selection and Classification in the Army

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14. ABSTRACT (<i>Maximum 200 words</i>). DOD will implement new norms for the Armed Services Vocational Aptitude Battery (ASVAB) in July 2004. These norms will reflect the 1997 Youth Population, replacing the 1980 Youth Population norms currently in effect. The purpose of this Study Note is to document the descriptive analyses undertaken to examine the impact of the new norms upon selection and classification in the Army (Regular, Reserve, and Guard). The analyses were conducted with 2002 - 2003 test data denominated in both 1980 and 1997 scale scores. Under the new norms and existing Army selection standards, and in the absence of newly focused recruiting effort, we would expect some decline in the proportions of Test Score Category (TSC) 1-3A and 3B applicants, and some increase in TSC 4. This holds for all three components. Greater effects are projected for racial-ethnic minorities, and for females to a lesser extent. With regard to classification, small adjustments to cutoff levels for Aptitude Area (AA) scores are recommended to maintain existing percentage qualification rates for Army MOS. The adjustments actually adopted by the Office of the Deputy Chief of Staff for Personnel (G-1) in some instances differ slightly from the ARI recommendations, and the cutoff score recommendations found in this paper do not represent official policy.					
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FOREWORD

The purpose of this report is to examine the effects upon Army enlistments of the renorming of the Armed Services Vocational Aptitude Battery (ASVAB) using the 1997 Youth Population as the reference group. ASVAB is the battery of tests that the military services use for enlisted selection and classification. When the performance of the youth population changes from one era to the next – it has shifted upwards since 1980 – military applicant test scores must be rescaled to new norms in order to compare the cognitive level of military applicants to that of contemporary youth. This paper discusses the implications of the renorming for selection and classification of Army applicants. Projected impacts were discussed with Army G-1 staff members, and used by that office in its decision to maintain current Army quality benchmarks and to make small adjustments in Aptitude Area (AA) composite score cutoff levels used for recruit classification.



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NOTE: The findings in this Study Note are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

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Introduction

The purpose of this Study Note is to document the descriptive analyses undertaken to measure the selection and classification impacts of DOD's decision to update the norms for the Armed Services Vocational Aptitude Battery (ASVAB) using a 1997 youth population standard (vice the 1980 youth population norms currently in use) derived from the 1997 Profile of American Youth (PAY97) study.¹

The Defense Manpower Data Center (DMDC) analyses reported by Segall (2004) refer to a sample of applicant first-time test takers during calendar year (CY) 2002, approximately 245,000 individuals characterized with interest in the Army Regular, Reserve, or Guard. Subsequently, DMDC provided the Services with data for CY 2003, and expanded the data fields to include most-recent test results as well. In examining the selection impacts, we utilize this CY 2002 – 2003 applicant file; this file contains approximately 479,000 ASVAB test takers with interest in the Army. In examining classification impacts, however, we utilized only those applicant records with corresponding Army enlistment contracts, determined by matching against an Enlisted Accession File (as updated through August 2003) maintained by the U.S. Army Recruiting Command (USAREC).

Selection Impacts

CY 2002-2003 Analyses – Regular Army

To build the analysis file for the impact analyses, we selected Regular Army applicants and screened out those with Armed Forces Qualification Test (AFQT) scores below 31 (on the 1980 scale). Applicants with scores below 31 are only accepted on an as-needed basis. The resulting files contained approximately 260,000 records.

The impact of the 1997 scale on the AFQT distribution is summarized in Table 1 for first-time test takers, and in Table 2 for most-recent-time test takers. The focus is upon the differences between the 1980 and 1997 scale scores for the CY 2002 – 2003 applicant data file. Note that differences tabulated for first-time test takers (Table 1) are very close to those reported by Segall (2004), Table 4.3, page 42. Looking at this table, at the 50th percentile there is a difference of 4.0 percentage points: approximately 4.0 percent of qualifying applicants would move from TSC 1-3A to 3B under the new norms. At the 31st percentile there is a difference of 6.9 percentage points: approximately 6.9 percent of applicants would move from qualifying at TSC 3B to non-qualifying under the new norms.²

¹ Moore et al. (1999) describes PAY97 sampling, and Bock et al. examines demographic influences on ASVAB test performance.

² Test score categories (TSC) are defined over the percentile scores on the Armed Forces Qualification Test (AFQT): TSC 1-3A, 50 – 99; TSC 3B, 31 – 49; TSC 4A, 16 – 30. The Army currently accepts individuals with scores in the TSC 4A range on an as-needed basis, typically limiting the share to about 2% of the annual accession cohort.

Table 1. AFQT - 1980 vs. 1997 Scales (Regular)

Cumulative AFQT Distribution: 1980 vs. 1997 Scales (CY 2002 – 2003 Regular Army Applicants) (First-time Test Takers)			
Percentile	1980 scale	1997 scale	Difference
93	6.8	6.8	0.0
65	41.8	41.3	-0.5
50	68.0	64.0	-4.0
31	100.0	93.1	-6.9
	253,561		

Table 2. AFQT - 1980 vs. 1997 Scales (Regular)

Cumulative AFQT Distribution: 1980 vs. 1997 Scales (CY 2002 – 2003 Regular Army Applicants) (Most-recent-time Test Takers)			
Percentile	1980 scale	1997 scale	Difference
93	6.6	6.6	0.0
65	41.0	40.5	-0.5
50	67.9	63.6	-4.3
31	100.0	92.4	-7.6
	259,735		

Table 2 reflects the effects of re-testing: applicants scoring just below important cutoff points on the 1980 scale are more likely to re-test. However, from a 1997 scale score perspective, the opportunity to re-test is not afforded applicants. Hence, use of most-recent-time test results is not scale score neutral and is apt to produce a biased estimate of the selection impact.³ Indeed, in comparing Tables 1 and 2, we see that re-testing led to approximately 6,000 additional applicants qualifying under the 1980 scale and that the corresponding percentage not qualifying under the 1997 scale score is slightly higher when re-testing is considered.

The selection impacts can also be described by test score category (TSC) rather than cumulatively – see Table 3. Under the 1997 scale, there are 10,142 fewer TSC 1-3A selectees (5.9% fewer), 7,354 fewer TSC 3B selectees (9.1% fewer), and 17,496 new TSC 4 selectees; these new selectees represent almost 22% of the parent (1980 scale) TSC 3B's.

³ See discussion in Segall (2004), p. 40.

Table 3. TSC Shares - 1980 vs. 1997 Scales (Regular)

Test Score Category Distribution: 1980 vs. 1997 Scales (CY 2002 – 2003 Regular Army Applicants) (First-time Test Takers)					
TSC	1980 scale		1997 scale		Difference
		%		%	
1 – 3A	172,421	68.0	162,279	64.0	-10,142
3B	81,140	32.0	73,786	29.1	-7,354
4	0	0.0	17,496	6.9	+17,496

The renorming is projected to have a slightly disproportionate impact on female applicants as shown in Table 4. Approximately 4.6 (3.9) percent female (male) applicants would move from TSC 1-3A to 3B at the existing quality marks. Approximately 8.9 (6.4) percent female (male) applicants would move from qualifying at TSC 3B to non-qualifying at the existing quality marks.

Table 4. Gender Impact - AFQT - 1989 vs. 1997 Scales (Regular)

Gender Impact – Cumulative AFQT Distribution: 1980 vs. 1997 Scales (CY 2002 – 2003 Regular Army Applicants) (First-time Test Takers)				
	Females		Males	
Percentile	1980 scale	1997 scale	1980 scale	1997 scale
93	4.1	4.2	7.5	7.5
65	34.8	34.2	43.8	43.8
50	62.1	57.5	69.6	65.7
31	100.0	91.1	100.0	93.6
	54,028		199,528	

The renorming is projected to have a disproportionate impact on minority applicants as shown in Table 5⁴. Approximately 5.3 (6.9) (4.9) (3.9) percent Black (Hispanic) (Other) (White) applicants would move from qualifying at TSC 1-3A to 3B at the existing quality marks. Approximately 14.5 (12.9) (12.2) (5.8) percent Black (Hispanic) (Other) (White) applicants would move from qualifying at TSC 3B to non-qualifying at the existing quality marks.

⁴ Race-ethnic comparisons are for CY 2002 only.

Table 5. Race-Ethnicity Impact - AFQT - 1980 vs. 1997 Scales (Regular)

Race-Ethnicity Impact – Cumulative AFQT Distribution: 1980 vs. 1997 Scales (CY 2002 Regular Army Applicants) (First-time Test Takers)								
	Black	Black	Hisp.	Hisp.	Other	Other	White	White
Percentile	1980 scale	1997 scale	1980 scale	1997 scale	1980 scale	1997 scale	1980 scale	1997 scale
93	1.6	1.6	1.8	1.8	6.8	6.7	8.1	8.2
65	22.3	21.4	25.5	23.7	38.0	36.9	47.1	46.9
50	49.2	43.8	53.1	47.2	62.5	58.2	73.1	69.5
31	100.0	86.5	100.0	88.3	100.0	90.5	100.0	94.9
	24,544		14,313		7,018		95,355	

The impact on female minority qualification is shown in Table 6.⁵ Approximately 5.3 (6.9) (4.9) (3.9) percent female Black (Hispanic) (Other) (White) applicants would move from qualifying at TSC 1-3A to 3B at the existing quality marks. Approximately 14.5 (12.9) (12.2) (5.8) percent female Black (Hispanic) (Other) (White) applicants would move from qualifying at TSC 3B to non-qualifying at the existing quality marks.

Table 6. Female Minority Impact - AFQT - 1980 vs. 1997 Scales (Regular)

Female Minority Impact – Cumulative AFQT Distribution: 1980 vs. 1997 Scales (CY 2002 Regular Army Applicants) (First-time Test Takers)								
	Black	Black	Hisp.	Hisp.	Other	Other	White	White
Percentile	1980 scale	1997 scale	1980 scale	1997 scale	1980 scale	1997 scale	1980 scale	1997 scale
93	1.0	1.1	1.2	1.0	5.1	5.1	5.9	5.9
65	20.2	19.9	22.2	20.4	31.6	30.9	42.3	42.2
50	46.9	41.6	49.5	42.6	57.4	52.5	69.9	66.0
31	100.0	85.5	100.0	87.1	100.0	87.8	100.0	94.2
	8,348		3,618		1,782		17,126	

CY 2002 Selection Analyses – Reserve

⁵ The impact on male minority qualification is not shown separately because it does not differ appreciably from Table 5.

To build the analysis file for the impact analyses, we selected those Army Reserve applicant first-time test takers and screened out those with AFQT (1980 scale) scores below 31. The resulting file contains 30,001 records.

The impact of the 1997 scale on the AFQT distribution is summarized in Table 7. The focus is upon the differences between the 1980 and 1997 scale scores as taken from the PAY97 CY 2002 source. As can be seen, at the 50th percentile there is a difference of 3.6 percentage points: approximately 3.6 percent of qualifying applicants would move from TSC 1-3A to 3B under the new norms. At the 31st percentile there is a difference of 5.8 percentage points: approximately 5.8 percent of applicants would move from qualifying at TSC 3B to non-qualifying under the new norms.

Table 7. AFQT - 1980 vs. 1997 Scales (Reserve)

Cumulative AFQT Distribution: 1980 vs. 1997 Scales (CY 2002 Army Reserve Applicants)			
Percentile	1980 scale	1997 scale	Difference
93	8.4	8.7	0.3
65	47.2	46.8	-0.4
50	71.9	68.3	-3.6
31	100.0	94.2	-5.8
	30,001		

The renorming is projected to have a somewhat disproportionate impact on female applicants as shown in Table 8. Approximately 4.5 (3.3) percent female (male) applicants would move from TSC 1-3A to 3B at the existing quality marks. Approximately 6.8 (5.4) percent female (male) applicants would move from qualifying at TSC 3B to non-qualifying at the existing quality marks.

Table 8. Gender Impact - AFQT - 1980 vs. 1997 Scales (Reserve)

Gender Impact - Cumulative AFQT Distribution: 1980 vs. 1997 Scales				
	Females		Males	
Percentile	1980 scale	1997 scale	1980 scale	1997 scale
93	5.2	5.2	9.7	10.1
65	40.0	39.2	50.2	50.0
50	66.8	62.3	74.0	70.7
31	100.0	93.2	100.0	94.6
	8,788		21,213	

The renorming is projected to have a disproportionate impact on minority applicants as shown in Table 9. Approximately 4.7 (5.6) (3.7) (2.9) percent Black (Hispanic) (Other) (White) applicants would move from qualifying at TSC 1-3A to 3B at the

existing quality marks. Approximately 10.0 (6.7) (5.7) (3.8) percent Black (Hispanic) (Other) (White) applicants would move from qualifying at TSC 3B to non-qualifying at the existing quality marks.

Table 9. Race-Ethnicity Impact - AFQT - 1980 vs. 1997 Scales (Reserve)

Race-Ethnicity Impact – Cumulative AFQT Distribution: 1980 vs. 1997 Scales								
	Black	Black	Hisp.	Hisp.	Other	Other	White	White
Percentile	1980	1997	1980	1997	1980	1997	1980	1997
	scale	scale	scale	scale	scale	scale	scale	scale
93	1.8	1.8	3.1	3.1	11.0	10.8	11.1	11.6
65	29.0	28.1	31.6	30.0	50.1	48.0	55.4	55.8
50	57.0	52.3	58.9	53.3	70.7	67.0	78.9	76.0
31	100.0	90.0	100.0	90.3	100.0	94.3	100.0	96.2
	6,228		3,015		1,676		19,082	

The compounded impact on female minority qualification is shown in Table 10. Approximately 5.1 (6.6) (3.9) (3.8) percent female Black (Hispanic) (Other) (White) applicants would move from qualifying at TSC 1-3A to 3B at the existing quality marks. Approximately 10.7 (9.1) (5.3) (4.3) percent female Black (Hispanic) (Other) (White) applicants would move from qualifying at TSC 3B to non-qualifying at the existing quality marks.

Table 10. Female Minority Impact - AFQT - 1980 vs. 1997 Scales (Reserve)

Female Minority Impact – Cumulative AFQT Distribution: 1980 vs. 1997 Scales								
	Black	Black	Hisp.	Hisp.	Other	Other	White	White
Percentile	1980	1997	1980	1997	1980	1997	1980	1997
	scale	scale	scale	scale	scale	scale	scale	scale
93	1.2	1.2	1.8	2.0	9.8	9.6	7.5	7.7
65	26.5	25.3	27.3	26.7	49.1	46.8	49.1	48.7
50	55.3	50.2	55.6	49.0	70.7	66.8	75.1	71.3
31	100.0	89.3	100.0	90.9	100.0	94.7	100.0	95.7
	2,670		905		509		4,704	

To build the analysis file for the impact analyses, we selected those Army National Guard applicant first-time test takers and screened out those with AFQT (1980 scale) scores below 31. The resulting file contains 39,238 records.

The impact of the 1997 scale on the AFQT distribution is summarized in Table 11. The focus is upon the differences between the 1980 and 1997 scale scores as taken from the PAY97 CY 2002 source. As can be seen, at the 50th percentile there is a difference of 4.0 percentage points: approximately 4.0 percent of qualifying applicants would move from TSC 1-3A to 3B under the new norms. At the 31st percentile there is a difference of 7.5 percentage points: approximately 7.5 percent of applicants would move from qualifying at TSC 3B to non-qualifying under the new norms.

Table 11. AFQT - 1980 vs. 1997 Scales (Guard)

Cumulative AFQT Distribution: 1980 vs. 1997 Scales (CY 2002 Army National Guard Applicants)			
Percentile	1980 scale	1997 scale	Difference
93	7.5	7.3	-0.2
65	43.2	42.6	-0.6
50	67.2	63.2	-4.0
31	100.0	92.5	-7.5
	39,238		

The renorming is projected to have a disproportionate impact on female applicants as shown in Table 12. Approximately 4.7 (3.8) percent female (male) applicants would move from TSC 1-3A to 3B at the existing quality marks. Approximately 9.4 (6.9) percent female (male) applicants would move from qualifying at TSC 3B to non-qualifying at the existing quality marks.

Table 12. Gender Impact - AFQT - 1980 vs. 1997 Scales (Guard)

Gender Impact - Cumulative AFQT Distribution: 1980 vs. 1997 Scales				
	Females		Males	
Percentile	1980 scale	1997 scale	1980 scale	1997 scale
93	4.6	4.4	8.4	8.2
65	34.7	34.3	45.8	45.2
50	61.0	56.3	69.2	65.4
31	100.0	90.6	100.0	93.1
	9,287		29,951	

The renorming is projected to have a disproportionate impact on minority applicants as shown in Table 13. Approximately 5.1 (5.9) (3.3) (3.6) percent Black (Hispanic) (Other) (White) applicants would move from qualifying at TSC 1-3A to 3B at the existing quality marks. Approximately 14.3 (14.4) (9.0) (5.4) percent Black (Hispanic)

(Other) (White) applicants would move from qualifying at TSC 3B to non-qualifying at the existing quality marks.

Table 13. Race-Ethnicity Impact - AFQT - 1980 vs. 1997 Scales (Guard)

Race-Ethnicity Impact – Cumulative AFQT Distribution: 1980 vs. 1997 Scales								
	Black	Black	Hisp.	Hisp.	Other	Other	White	White
Percentile	1980 scale	1997 scale	1980 scale	1997 scale	1980 scale	1997 scale	1980 scale	1997 scale
93	1.8	1.8	1.8	1.7	8.1	7.9	9.0	8.9
65	23.1	22.7	23.6	22.8	42.6	41.4	48.9	48.4
50	48.4	43.3	49.5	43.6	65.0	61.7	72.6	69.0
31	100.0	85.7	100.0	85.6	100.0	91.0	100.0	94.6
	5,488		2,841		1,725		29,184	

The renorming is projected to have a compounded impact on female minority qualification as shown in Table 14. Approximately 5.4 (5.7) (2.5) (4.5) percent female Black (Hispanic) (Other) (White) applicants would move from qualifying at TSC 1-3A to 3B at the existing quality marks. Approximately 15.3 (15.4) (8.6) (6.7) percent female Black (Hispanic) (Other) (White) applicants would move from qualifying at TSC 3B to non-qualifying at the existing quality marks.

Table 14. Female Minority Impact - AFQT - 1980 vs. 1997 Scales (Guard)

Female Minority Impact – Cumulative AFQT Distribution: 1980 vs. 1997 Scales								
	Black	Black	Hisp.	Hisp.	Other	Other	White	White
Percentile	1980 scale	1997 scale	1980 scale	1997 scale	1980 scale	1997 scale	1980 scale	1997 scale
93	1.2	1.4	0.7	0.7	5.5	6.4	6.1	9.0
65	19.0	18.8	19.4	18.3	35.2	34.6	41.6	41.3
50	44.9	39.5	46.3	40.6	59.1	56.6	68.2	63.7
31	100.0	84.7	100.0	84.6	100.0	91.4	100.0	93.3
	2,015		721		440		6,111	

1998 Selection Analyses⁶

It is useful to compare the results for CY 2002, a relatively good recruiting year, with similar analyses for 1998, a more difficult recruiting year. With 1980 and 1997 scale score data available for the CY 2002 sample provided by DMDC, we utilized FY 1998

⁶ These analyses examine data that were available earlier; they utilize CY 2002 first-time test taker records as the baseline.

Army contracts as a sampling frame from which to draw 50 random samples of 5,000 records each from the PAY97 CY 2002 data, stratified by test score category. Separate sets of sampling and analyses were conducted: for the entire group, for males and females, and for Black, Hispanic, Other, and White groups. The same procedures were followed using FY 2002 Army contracts data for the sampling frame in order to construct baseline year results for comparison with 1998 results.

To illustrate the sampling procedures, consider the sampling / tabulations undertaken for the male subset from the PAY97 CY 2002 file for 1998, following these directions:

- a. For each replication, randomly draw 5,000 records from the PAY97 male file, with sampling in proportion to the AFQT test score categories across males as determined from the 1998 Army contract tabulations (with AFQT \geq 31). For example, if TSC IIIA accounts for 30% (of the males), draw 1500 ($= .30 * 5000$) records from that stratum.
- b. After the 50 replications are drawn, create a "summary" file over the 50 replications for the variables of interest (AFQT80, AFQT97), by summing their frequencies at each score level.
- c. Use the summary file to create percentage cumulative frequency tables in which each (1980,1997) pair is compared at each score level.

The estimated AFQT percentile distributions for FY 1998 and FY 2002 – using the replicated sampling described – are shown in Table 15. Relative to FY 2002, the impact of more difficult recruiting conditions in FY 1998 is to slightly increase the percentage of contracts that would move from TSC 1-3A (3B) to 3B (4) contracts under the new

Table 15. FY 1998 vs. FY 2002 Baseline: AFQT – 1980 vs. 1997 Scales

Cumulative AFQT Impact: FY 1998 vs. FY 2002 (Baseline) (CY 2002 All Army Applicants) (First-time Test Takers)						
	FY 2002			FY 1998		
Percentile	1980 scale	1997 scale	Diff	1980 scale	1997 scale	Diff
All						
93	5.5	5.7	0.2	4.0	4.4	0.4
65	40.5	39.4	-1.2	37.3	36.4	-0.9
50	70.8	66.0	-4.8	69.1	64.1	-5.0
31	100.0	94.1	-5.9	100.0	93.8	-6.2

score scales. When considering the entire sample (i.e., All), the impact of a relatively difficult (over a good) recruiting year is projected to lead to an increase of 0.2 percentage points in the proportion of contractees moving from TSC 1-3A to 3B, and to an increase of 0.3 percentage points in the proportion of contractees moving from TSC 3B to 4.

The results of these comparative descriptive analyses by demographic groups are shown in Table 16. The impact of a difficult (over a good) recruiting year is most striking for females (and racial-ethnic minorities to a lesser extent): the impact at the 50th percentile is projected to be noticeably larger, and at the 31st percentile noticeably

smaller. In other words, for females most of the impact of difficult recruiting is estimated to occur in TSC 1-3A contracts moving to 3B contracts under the new score scale (rather than in TSC 3B contracts moving to 4 contracts).

Table 16. Demographic Impacts - FY 1998 vs. FY 2002 Baseline

Cumulative AFQT Impact: 1998 vs. 2002 (Baseline) Percentage Point Differences (Diff) Between 1980 and 1997 Scale Scores (CY 2002 All Army Applicants) (First-time Test Takers)		
	FY 2002	FY 1998
All		
93	0.2	0.4
65	-1.2	-0.9
50	-4.8	-5.0
31	-5.9	-6.2
Males		
93	0.3	0.4
65	-1.3	-1.1
50	-4.7	-4.5
31	-5.6	-6.7
Females		
93	0.2	0.3
65	-0.9	-0.9
50	-5.4	-7.6
31	-7.4	-3.9
Black		
93	0.0	0.1
65	-1.5	-1.4
50	-6.1	-6.6
31	-11.2	-10.9
Hispanic		
93	-0.1	-0.1
65	-2.6	-2.2
50	-6.7	-7.1
31	-10.3	-10.5
Other		
93	0.1	0.4
65	-1.9	-1.5
50	-4.6	-5.6
31	-8.5	-8.4
White		
93	0.4	0.5
65	-0.9	-0.7
50	-4.2	-4.3
31	-3.6	-3.9

Summary – Selection Effects

In summary, in the absence of new and/or refocused recruiting efforts, the Army (Regular, Reserve, and Guard) is likely to recruit a relatively larger share of TSC 4, and smaller shares of TSC 1-3A and TSC 3B once the 1997 Youth Population standards are implemented. The flow down of 1-3As into TSC 3B is more than matched by the flow down of 3Bs into TSC 4. The renorming is projected to have a disproportionate selection impact upon minorities and, to a lesser extent, upon females – especially as recruiting becomes more difficult.

Classification Impacts

Impact of the Renorming upon ASVAB Subtest and AA Composite Scores

The major finding of the 1997 renorming survey is that, relative to the 1980 youth population, today's youth is scoring higher along verbal and math dimensions and lower along "technical" dimensions⁷:

"Table 2.1 indicates generally equal or higher performance levels for PAY97 youth on math and verbal tests (AR, WK, PC, MK, and VE), and lower performance levels for most technical tests (AS, MC, EI). The new '97 score-scale will be constructed by linearly transforming PAY97 sample scores in a way that results in means and standard deviations of 50 and 10, respectively. Consequently, for the PAY97 sample, average scores on the '97 scale would be expected to increase (relative to the '80 scale) for those subtests having means below 50 (GS, AR, PC, AS, MC, and EI), and decrease for those subtests having means above 50 (WK, MK, and VE)." (Segall, 2004, Chapter 2, pp. 8-9.)

In the Army ASVAB subtests are combined to form ten Aptitude Area (AA) composites for classification purposes.⁸ The subtests are combined using least-squares weights derived from analyses of the relationship between Soldier performance and ASVAB subtest scores.⁹ Under the renorming, the 1980 scale score weights are adjusted to reflect the 1997 scale, while maintaining their optimal classification properties. Segall (Chapter 2, pp. 18-21) describes the adjustment procedures. Adjusted relative weights¹⁰ are shown in Table 17 (where each row corresponds to a composite).

Occupational impact analyses and comparisons are reported for Regular component contractees, screening out those records with AFQT (1980 scale) scores below 31 and

⁷ The ASVAB subtests currently used in the AA composites are as follows: GS – general science; AR – arithmetic reasoning; MK – mathematics knowledge; MC – mechanical comprehension; EI – electronics information; AS – auto & shop information; WK – word knowledge; PC – paragraph comprehension; VE – verbal; combines WK and PC.

⁸ The AA composites / job families are as follows: CL – clerical; CO – combat; EL – electronics repair; FA – field artillery; GM – general maintenance; MM – mechanical maintenance; OF – operators / food; SC – surveillance / communication; ST – skilled technical; GT – general technical.

⁹ Zeidner, Johnson, Vladimirsky, and Weldon estimate least-squares weighted composites and propose a two-tiered classification system (Zeidner, 2000; Greenston, 2002).

¹⁰ The highest relative weight is 1.0, and the lowest is 0.0. See Appendix A for the actual weights.

using most-recent test results.¹¹ There are 112,985 Regular component records in the analysis sample; they account for 95.9% of the total matched sample (described in the Introduction). The percentage qualifying under 1980 and 1997 score scales at line scores between 85 and 115 are shown for Army composites in Tables 18.1 to 18.10.¹²

Table 17. AA Composites (Relative Weights)

AA composites: relative LSE weights, as adjusted to PAY97 renorming

	GS	AR	MK	MC	EI	AS	VE
CL	0.000	1.000	0.781	0.154	0.103	0.100	0.904
CO	0.313	0.522	1.000	0.607	0.315	0.649	0.479
EL	0.167	0.887	0.983	0.528	0.606	0.737	1.000
FA	0.250	0.702	1.000	0.714	0.272	0.596	0.531
GM	0.465	0.917	0.896	0.579	0.598	1.000	0.426
MM	0.068	0.376	0.327	0.454	0.353	1.000	0.242
OF	0.267	1.000	0.635	0.686	0.367	0.938	0.685
SC	0.019	0.673	1.000	0.394	0.506	0.387	0.829
ST	0.207	0.788	0.769	0.502	0.233	0.350	1.000

Per the major finding of the renorming project just noted, the classification impacts will vary predictably across Army composites, and reflect the subtest composition of those composites. We find that the percentage qualifying for GT, CL, SC, and ST composites – which are relatively verbal and math intensive – to be somewhat lower on the 1997 scale (relative to the 1980 scale). At the other extreme, the percentage qualifying for MM, GM, and OF composites – which are relatively technical subtest intensive – is somewhat higher on the 1997 scale. In the middle, the percentage qualifying for EL, CO, and FA composites – reflecting a more balanced mixture of subtests – is about the same on the 1997 scale (as the 1980 scale).

The percentage qualifying results shown in Tables 18.1 – 18.10 are summarized in Table 19. The table depicts the line score range of interest, the direction of the difference in the percentage qualifying on the 1997 scale relative to the 1980 scale, and an approximate adjustment to cut score levels if the policy intent is to maintain the same percentage qualifying at current levels. With the exception of GM and MM composites, adjustments to cut scores would be up or down one point at most.

¹¹ Presumably most-recent scores used for enlisting.

¹² These tabulations assume that those qualifying under the 1980 scale score (i.e. AFQT(1980) >= 31) would be considered for contracting under the 1997 scale score; that is, the 1997 scale distribution of Army Regular contractees contains 6.7% TSC 4.

Table 18.1 Percentage Qualifying – Composites / Job Families - 1980 vs. 1997 Scales

TABLE. Percentage Qualifying – GT

CUT SCORE	GT80	GT97	DIFF
115	28.9	26.9	-2.0
114	31.9	29.4	-2.5
113	35.0	32.1	-2.9
112	38.2	34.9	-3.3
111	41.2	37.8	-3.4
110	44.6	40.8	-3.8
109	48.1	44.1	-4.0
108	51.7	47.4	-4.3
107	54.8	47.4	-7.4
106	54.8	50.8	-4.0
105	58.4	54.3	-4.1
104	61.9	57.7	-4.2
103	65.3	61.1	-4.2
102	68.3	64.3	-4.0
101	71.3	67.5	-3.8
100	74.2	70.5	-3.7
99	77.0	73.4	-3.6
98	79.4	76.1	-3.3
97	81.9	78.8	-3.1
96	84.5	81.2	-3.3
95	86.7	83.6	-3.1
94	89.0	86.0	-3.0
93	91.2	86.0	-5.2
92	91.2	88.4	-2.8
91	93.2	90.4	-4.4
90	94.8	92.4	-3.8
89	96.2	94.2	-3.2
88	97.4	95.6	-2.7
87	98.3	96.9	-2.0
86	98.9	97.9	-1.5
85	99.4	98.6	-0.8
84	99.7	99.1	-0.6
83	99.8	99.5	-0.3

Table 18.2. Percentage Qualifying – CL – 1980 vs. 1997 Scales

TABLE. Percentage Qualifying -- CL

CUT SCORE	CL80	CL97	DIFF
115	29.8	27.6	-2.2
114	32.4	29.9	-2.5
113	35.0	32.5	-2.5
112	37.9	35.1	-2.8
111	40.8	37.9	-2.9
110	43.8	40.8	-3.0
109	46.9	43.8	-3.1
108	50.2	47.0	-3.2
107	53.4	50.1	-3.3
106	56.7	53.4	-3.3
105	60.1	56.7	-3.4
104	63.3	60.1	-3.2
103	66.7	63.5	-3.2
102	69.7	66.8	-2.9
101	72.6	69.9	-2.7
100	75.3	72.7	-2.6
99	77.7	75.3	-2.4
98	80.1	77.7	-2.4
97	82.4	80.1	-2.3
96	84.6	82.3	-2.3
95	86.8	84.5	-2.3
94	89.1	86.7	-2.4
93	91.3	88.9	-2.4
92	93.5	91.0	-2.5
91	95.4	93.1	-2.3
90	97.0	94.9	-2.1
89	98.2	96.4	-1.8
88	99.1	97.7	-1.4
87	99.6	98.6	-1.0
86	99.9	99.3	-0.6
85	100.0	99.6	-0.4

Table 18.3. Percentage Qualifying – CO– 1980 vs. 1997 Scales

TABLE. Percentage Qualifying -- CO

CUT SCORE	CO80	CO97	DIFF
115	27.9	31.7	3.8
114	30.4	34.2	3.8
113	33.0	36.7	3.7
112	35.7	39.4	3.7
111	38.4	42.1	3.7
110	41.2	44.8	3.6
109	44.0	47.7	3.7
108	47.0	50.5	3.5
107	50.0	53.4	3.4
106	52.9	56.2	3.3
105	55.8	59.0	3.2
104	58.8	61.7	2.9
103	61.6	64.5	2.9
102	64.4	67.2	2.8
101	67.2	69.9	2.7
100	70.1	72.5	2.4
99	72.7	75.0	2.3
98	75.3	77.4	2.1
97	77.8	79.7	1.9
96	80.1	81.8	1.7
95	82.3	83.9	1.6
94	84.4	85.9	1.5
93	86.4	87.7	1.3
92	88.4	89.4	1.0
91	90.1	91.0	0.9
90	91.7	92.4	0.7
89	93.1	93.7	0.6
88	94.4	94.8	0.4
87	95.6	95.8	0.2
86	96.6	96.7	0.1
85	97.5	97.5	0.0

Table 18.4. Percentage Qualifying – EL – 1980 vs. 1997 Scales

TABLE. Percentage Qualifying -- EL

CUT SCORE	EL80	EL97	DIFF
118	20.2	24.6	4.4
117	22.4	26.8	4.4
116	24.8	29.1	4.3
115	27.3	31.5	4.2
114	29.8	34.0	4.2
113	32.3	36.5	4.2
112	35.1	39.1	4.0
111	38.0	41.9	3.9
110	40.9	44.6	3.7
109	43.9	47.5	3.6
108	46.9	50.3	3.4
107	50.0	53.2	3.2
106	53.0	55.9	2.9
105	56.0	58.8	2.8
104	59.0	61.6	2.6
103	62.0	64.4	2.4
102	64.9	67.1	2.2
101	67.8	69.8	2.0
100	70.6	72.5	1.9
99	73.4	74.9	1.5
98	76.0	77.4	1.4
97	78.5	79.6	1.1
96	80.8	81.8	1.0
95	83.0	83.9	0.9
94	85.2	85.9	0.7
93	87.1	87.7	0.6
92	89.0	89.5	0.5
91	90.7	91.0	0.3
90	92.4	92.5	0.1
89	93.8	93.8	0.0
88	95.1	95.0	-0.1
87	96.3	96.0	-0.3
86	97.2	97.0	-0.2
85	98.1	97.8	-0.3

Table 18.5. Percentage Qualifying – FA – 1980 vs. 1997 Scales

TABLE. Percentage Qualifying -- FA

CUT SCORE	FA80	FA97	DIFF
115	28.4	31.5	3.1
114	30.9	34.1	3.2
113	33.5	36.6	3.1
112	36.1	39.3	3.2
111	38.9	41.9	3.0
110	41.6	44.7	3.1
109	44.4	47.6	3.2
108	47.4	50.5	3.1
107	50.4	53.3	2.9
106	53.3	56.2	2.9
105	56.2	59.1	2.9
104	59.1	61.8	2.7
103	62.0	64.6	2.6
102	64.8	67.5	2.7
101	67.6	70.2	2.6
100	70.4	72.8	2.4
99	73.0	75.3	2.3
98	75.6	77.7	2.1
97	78.0	80.0	2.0
96	80.4	82.2	1.8
95	82.5	84.3	1.8
94	84.7	86.2	1.5
93	86.7	88.1	1.4
92	88.6	89.8	1.2
91	90.4	91.3	0.9
90	91.9	92.8	0.9
89	93.4	94.1	0.7
88	94.7	95.2	0.5
87	95.8	96.2	0.4
86	96.8	97.0	0.2
85	97.7	97.8	0.1

Table 18.6. Percentage Qualifying – GM – 1980 vs. 1997 Scales

TABLE. Percentage Qualifying -- GM

CUT SCORE	GM80	GM97	DIFF
115	26.7	32.5	5.8
114	29.0	35.0	6.0
113	31.5	37.5	6.0
112	34.1	40.1	6.0
111	36.8	42.8	6.0
110	39.6	45.4	5.8
109	42.4	48.2	5.8
108	45.2	50.8	5.6
107	48.0	53.5	5.5
106	50.8	56.1	5.3
105	53.6	58.7	5.1
104	56.5	61.4	4.9
103	59.3	64.1	4.8
102	62.0	66.7	4.7
101	64.8	69.2	4.4
100	67.5	71.6	4.1
99	70.1	74.0	3.9
98	72.6	76.4	3.8
97	75.2	78.6	3.4
96	77.5	80.7	3.2
95	79.8	82.7	2.9
94	81.9	84.6	2.7
93	83.9	86.3	2.4
92	85.9	88.1	2.2
91	87.8	89.6	1.8
90	89.4	91.0	1.6
89	90.9	92.3	1.4
88	92.4	93.5	1.1
87	93.7	94.6	0.9
86	94.9	95.5	0.6
85	96.0	96.4	0.4
84	96.9	97.2	0.3

Table 18.7. Percentage Qualifying – MM – 1980 vs. 1997 Scales

TABLE. Percentage Qualifying -- MM

CUT SCORE	MM80	MM97	DIFF
115	25.0	34.4	9.4
114	27.2	36.7	9.5
113	29.5	39.0	9.5
112	31.9	41.4	9.5
111	34.3	43.8	9.5
110	36.8	46.3	9.5
109	39.4	48.7	9.3
108	42.0	51.1	9.1
107	44.7	53.5	8.8
106	47.4	55.9	8.5
105	50.0	58.4	8.4
104	52.5	60.7	8.2
103	55.2	63.1	7.9
102	57.8	65.4	7.6
101	60.4	67.6	7.2
100	62.9	69.8	6.9
99	65.3	72.0	6.7
98	67.7	74.1	6.4
97	70.1	76.2	6.1
96	72.4	78.1	5.7
95	74.6	80.0	5.4
94	76.7	81.8	5.1
93	78.9	83.4	4.5
92	80.8	85.1	4.3
91	82.7	86.7	4.0
90	84.6	88.2	3.6
89	86.3	89.6	3.3
88	87.9	90.9	3.0
87	89.5	92.0	2.5
86	90.9	93.1	2.2
85	92.2	94.0	1.8

Table 18.8. Percentage Qualifying – OF – 1980 vs. 1997 Scales

TABLE. Percentage Qualifying -- OF

CUT SCORE	OF80	OF97	DIFF
115	27.1	32.5	5.4
114	29.5	35.0	5.5
113	32.0	37.5	5.5
112	34.6	40.2	5.6
111	37.4	42.9	5.5
110	40.2	45.4	5.2
109	42.9	48.1	5.2
108	45.7	50.8	5.1
107	48.5	53.5	5.0
106	51.3	56.1	4.8
105	54.1	58.8	4.7
104	57.0	61.4	4.4
103	59.8	64.1	4.3
102	62.5	66.7	4.2
101	65.2	69.2	4.0
100	67.8	71.8	4.0
99	70.5	74.2	3.7
98	73.1	76.4	3.3
97	75.6	78.7	3.1
96	77.9	80.8	2.9
95	80.1	82.8	2.7
94	82.2	84.6	2.4
93	84.2	86.4	2.2
92	86.1	88.1	2.0
91	87.9	89.7	1.8
90	89.6	91.1	1.5
89	91.2	92.4	1.2
88	92.6	93.6	1.0
87	93.9	94.7	0.8
86	95.0	95.7	0.7
85	96.1	96.6	0.5

Table 18.9. Percentage Qualifying – SC – 1980 vs. 1997 Scales

TABLE. Percentage Qualifying – SC

CUT SCORE	SC80	SC97	DIFF
115	28.1	30.5	2.4
114	30.6	33.0	2.4
113	33.3	35.5	2.2
112	36.0	38.2	2.2
111	38.9	41.0	2.1
110	41.9	43.9	2.0
109	45.0	46.8	1.8
108	48.1	49.8	1.7
107	51.3	52.7	1.4
106	54.4	55.8	1.4
105	57.6	58.8	1.2
104	60.7	61.8	1.1
103	63.8	64.7	0.9
102	66.8	67.6	0.8
101	69.8	70.3	0.5
100	72.6	73.0	0.4
99	75.3	75.7	0.4
98	78.0	78.2	0.2
97	80.4	80.5	0.1
96	82.7	82.7	0.0
95	84.9	84.8	-0.1
94	87.1	86.9	-0.2
93	89.1	88.8	-0.3
92	91.0	90.6	-0.4
91	92.7	92.2	-0.5
90	94.2	93.8	-0.4
89	95.6	95.1	-0.5
88	96.8	96.1	-0.7
87	97.8	97.1	-0.7
86	98.5	97.9	-0.6
85	99.1	98.6	-0.5

Table 18.10. Percentage Qualifying – ST – 1980 vs. 1997 Scales

TABLE. Percentage Qualifying -- ST

CUT SCORE	ST80	ST97	DIFF
115	28.7	30.1	1.4
114	31.3	32.6	1.3
113	34.0	35.2	1.2
112	36.8	37.8	1.0
111	39.7	40.6	0.9
110	42.7	43.4	0.7
109	45.7	46.3	0.6
108	48.8	49.3	0.5
107	51.9	52.3	0.4
106	55.0	55.2	0.2
105	58.2	58.3	0.1
104	61.3	61.4	0.1
103	64.3	64.3	0.0
102	67.4	67.1	-0.3
101	70.2	70.0	-0.2
100	73.0	72.7	-0.3
99	75.6	75.2	-0.4
98	78.1	77.7	-0.4
97	80.5	80.1	-0.4
96	82.8	82.3	-0.5
95	85.0	84.5	-0.5
94	87.1	86.6	-0.5
93	89.1	88.5	-0.6
92	91.0	90.4	-0.6
91	92.7	92.0	-0.7
90	94.3	93.6	-0.7
89	95.7	95.0	-0.7
88	96.9	96.2	-0.7
87	97.9	97.2	-0.7
86	98.7	98.1	-0.6
85	99.3	98.7	-0.6

Table 19. Percentage Qualifying – Composite – Line Score Range

Composite / Job Family	Line score range	Percentage qualifying on the 1997 scale is	Approximate adjustment to cut score that maintains current qualification rate
GT	95 – 110	Lower	- 1.0
CL	95 – 110	Lower	- 1.0
SC	95 – 110	Higher	+ 0.0 to + 0.5
ST	95 – 110	Lower / higher	0.0
EL	101 – 115	Higher	+ 1.0
CO	90 – 100	Higher	+ 0.5 to +1.0
FA	90 – 100	Higher	+ 0.5 to +1.0
OF	90 – 105	Higher	+ 1.0 to +1.5
GM	85 – 110	Higher	+ 0.0 to +2.0
MM	95 – 110	Higher	+ 3.0 to +4.0

Percentage Qualifying by Job Family

The previous discussion explored the general direction of cut score adjustments over a range of line scores. We now turn to the particular cut scores currently in place and make specific recommendations for adjustments that would leave the percentage qualifying about the same. These are shown in Table 20, and are based on the data shown in Tables 18.1 – 18.10. To take an example, consider the CL composite; Table 18.2 shows that at a cut score of 88 on the 1980 scale, the qualifying rate is 99.1; using this table we find that a cut score on the 1997 scale of 86 produces about the same qualifying rate (99.3 percent) – hence the recommendation shown in Table 20. Also shown on the right-side in Table 20 are the projected impacts upon minority groups. As can be seen, the recommended adjustments turn out to leave the minority percentage qualifying about the same. Table 20 also shows a recommended cut score for the two-year period during which 1980 scale scores are “grandfathered” in the system. Adoption of these adjustments would allow the Army to maintain a single set of cut scores with minimum inequity while two different scale scores are in use during the transition period.

For a number of MOS cut scores are defined over a combination of two or more AA composites; these are referred to as Special (SP) criteria. Existing SP and recommended changes are shown in Table 21.¹³

¹³ Recommended changes are derived in a three step process: (i) over the entire eligible sample (i.e. Army Regular contractees with AFQT (1980) scores of 31 or greater) and for the “dominant” composite, find the cut score on the 1997 scale which provides about the same percentage qualifying as under the existing 1980 scale cut score; (ii) for a sample restricted to those meeting or exceeding the 1980 scale cut score on the dominant composite, determine the percentage qualifying on the other composite; (iii) for a sample restricted to those meeting or exceeding the 1997 scale cut score on the dominant composite, determine the line score at which the percentage qualifying on the other composite on the 1997 scale is approximately the same as that found in the previous step on the 1980 scale.

Table 20. Recommendations: Cut Score Adjustments

	80	97	During transition	Percentage Qualifying at (females)		Percentage Qualifying at (Hispanic-Black)	
	Current	Recom- mended		80 Current	97 Recomm.	80 Current	97 Recomm.
CL	88	86	87	99.4	99.4	98.0	98.4
	92	91	91	88.8	88.1	86.8	86.2
	97	96	96	73.8	73.6	68.1	68.0
	103	102	102	54.3	54.1	46.7	46.2
	107	106	106	39.9	40.0	33.0	32.2
CO	87	87	87			88.8	89.4
	98	99	99			52.1	51.1
EL	87	87	87	89.3	88.7	90.3	89.6
	89	89	89	83.9	83.9	84.5	84.5
	93	93	93	71.5	72.4	70.9	71.8
	98	98	98	54.2	56.2	52.7	54.3
	102	103	103	39.7	39.3	38.5	37.4
	107	108	107	25.2	25.6	23.8	23.8
	116	118	117	8.3	8.5	7.9	7.5
FA	93	93	93	71.0	73.3	70.7	73.8
	96	97	96	61.1	60.4	60.1	59.2
GM	84	84	84	90.6	91.5	91.5	92.4
	88	88	88	79.7	82.3	81.0	83.5
	93	94	93	63.5	64.5	64.2	65.2
	97	98	97	49.3	51.1	50.3	51.7
	104	106	105	27.5	27.1	28.6	27.6
GT	85	83	84	98.7	98.9	98.5	98.8
	90	89	89	90.9	90.1	88.8	87.6
	95	94	94	79.3	78.5	74.3	73.1
	100	99	99	63.3	62.5	55.5	54.3
	105	104	104	45.8	45.7	36.9	35.8
	110	109	109	32.3	32.9	24.2	23.4
MM	87	89	88	70.8	71.3	74.2	74.2
	92	94	93	53.0	54.9	57.8	59.1
	97	100	98	35.9	35.9	41.9	41.1
	102	105	103	22.4	23.1	28.3	28.3
OF	85	85	85	88.6	89.6	89.6	90.7
	95	96	95	57.2	58.0	57.6	58.3
SC	90	90	90	86.1	85.2	86.2	85.2
	93	93	93	77.0	76.4	76.0	75.3
	98	98	98	60.6	60.8	57.9	57.8
	105	105	105	35.7	36.7	32.9	33.6
ST	85	85	85	97.9	96.3	98.0	96.6
	92	92	92	80.2	79.2	79.0	77.8
	96	96	96	67.9	67.1	64.4	63.6
	102	102	102	47.0	46.9	42.6	42.0
	107	107	107	30.8	31.2	26.9	26.8
	113	113	113	16.4	17.5	13.4	13.9

Table 21. Recommendations: Cut Score Adjustments – Combination Criteria

Special AA cut-off score definitions(SP) currently in place

SP	CL	CO	EL	FA	GM	GT	MM	OF	SC	ST
1					97	110				107
2						100	97			
3		98				110				
4			93							92
5			98						98	
6			102						105	
7			89						90	
8			93						93	
9					97/88	85				
10					97/88	90				
11						95	87/97			
12						90	87/97			
13						85	87/92			
14			93				102			
15			98				102			
16	88							85		
17						110				102
18		87			88					
19									93	102
20			87						93	
21					93/88	85				
22					97/88	95				
23					97/88	85				
24			98/93			90				
25					97/93	90				
26						85	87/92			

Recommended changes in response to renorming
Special AA cut-off score definitions(SP)

SP	CL	CO	EL	FA	GM	GT	MM	OF	SC	ST
1					98	109				107
2						99	100			
3		99				109				
4			93							92
5			98						98	
6			102						105	
7			89						90	
8			93						93	
9					98/89	83				
10					98/89	89				
11						94	89/100			
12						89	89/100			
13						83	89/95			
14			93				105			
15			98				105			
16	86							85		
17						109				102
18		87			88					
19									93	102
20			87						93	
21					94/89	83				
22					98/89	94				
23					98/89	83				
24			98/93			89				
25					98/94	89				
26						83	89/95			

Note – how to read this table. For example, SP 16 says that eligibility requires CL of 88 and OF of 85; SP 26 says that eligibility requires GT of 85 and MM of 87, or MM of 92.

References

Bock, R.D. & Zimowski, M. (in preparation). *1997 Profile of American Youth: Demographic Influences on ASVAB Test Performance*. Chicago, IL: National Opinion Research Center.

Moore, W., Pedlow, S., & Wolter, K. (1999). *Profile of American Youth 1997 (PAY97): Technical Sampling Report*. Chicago, IL: National Opinion Research Center.

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Appendix A

The LSE composite weights, adjusted for implementation with the PAY97 renorming, are shown in the table below. Each row corresponds to an AA composite; for an individual, each composite score is the sum of the products of ASVAB subtest weights (each column) and subtest scores, plus the constant term (k).

	GS	AR	MK	MC	EI	AS	VE	k
CL	0	0.75179	0.58715	0.11541	0.07756	0.07489	0.67976	-14.32772
CO	0.19868	0.3309	0.63397	0.38486	0.19979	0.41161	0.30347	-23.17105
EL	0.08324	0.44254	0.49064	0.26341	0.30258	0.36786	0.49906	-22.46667
FA	0.15031	0.42263	0.60172	0.42966	0.16389	0.35866	0.31958	-22.32119
GM	0.23521	0.46357	0.45285	0.2928	0.30216	0.50542	0.21527	-23.36174
MM	0.05942	0.32829	0.28517	0.39607	0.30796	0.87309	0.2115	-23.08481
OF	0.14306	0.53676	0.34092	0.36843	0.19683	0.50334	0.36757	-22.84882
SC	0.01235	0.42812	0.6365	0.2507	0.32194	0.24636	0.5277	-21.18951
ST	0.12865	0.4901	0.47825	0.31207	0.14493	0.21736	0.62177	-19.65219